Volume 25 Project No. AFS-48

STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

ANCHOR RIVER STEELHEAD STUDY

By

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Volume 25 Project No. AFS-48

RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project No: AFS-48

Segment No: AFS-48* Study Title: ANADROMOUS FISH STUDIES

Job Title: Anchor River Steelhead Study

Cooperators: Joe Wallis and D. Thomas Balland

Period Covered: July 1, 1983 to June 30, 1984

ABSTRACT

Inclined plane traps, minnow traps and gill nets were used to capture juvenile steelhead trout, Salmo gairdneri (Richardson), coho salmon, Oncorhynchus kisutch (Walbaum), chinook salmon, Oncorhynchus tschawytscha (Walbaum), and Dolly Varden, Salvelinus malma (Walbaum), in Anchor River during the period from May 4 through October 26, 1983. Minnow traps were the most effective in capturing juveniles of all species. The large inclined plane trap did not trap effectively due to low stream flows; however, small inclined plane traps were effective in trapping emergent steelhead fry.

Too few steelhead smolts were captured to provide an indication of their time of migration or size distribution.

One hundred thirty-three adult steelhead, tagged with Floy Anchor tags, formed the basis for a population estimate of 1,682 steelhead in the 1983 run into Anchor River.

Twenty-one adult steelhead were tagged with radio transmitters in the fall of 1982. Several fish were tracked throughout the winter and spring, and provided information on instream movements and time and location of their spawning. Five additional adult steelhead were tagged during the spring of 1983 and provided limited data on instream movements.

A creel census was conducted on the Anchor River in 1983 and an estimated 6,941 angler-days of effort were spent during the period from

* This report is numbered for sake of consistency, however, this project received no federal dollars this year.

August 13 through October 31. During this summer-fall fishery, it was estimated that anglers retained only 40 percent of the steelhead they caught for a total harvest of 433 steelhead.

Samples from the adult run were comprised of 13 separate age classes. First-spawning fish were of 5 age classes and repeat spawners consisted of 8 separate age classes. The majority of first-spawning females were Age Class 3.2, and the majority of first-spawning males were Age Class 3.1. Repeat spawners comprised over 25 percent of the fish sampled.

Observations of spawning steelhead were made in several locations throughout the watershed.

Bacterial kidney disease, (Renibacterium salmoninarus), was detected in wild adult steelhead trout from Anchor River.

KEY WORDS

Steelhead trout, migrant trap, radio telemetry, tagging, minnow traps, steelhead smolt, Anchor River, spawning, sportfishing effort, harvest, population estimate.

BACKGROUND

A vicinity map showing location of the study area is presented in Figure 1, and a list of fish species is presented in Table 1.

In the Cook Inlet area, steelhead trout occur in only a few streams of the lower Kenai Peninsula--Anchor River, Ninilchik River, Stariski Creek, Deep Creek and a limited population in Crooked Creek, a Kasilof River tributary. We have limited information regarding numbers of fish in these streams, but the total numbers are known to be comparatively small.

Anchor River, the southernmost steelhead stream on the Kenai Peninsula, appears to have the largest run and is the site of the most intense fishery. Fifteen thousand to 20,000 man-days of angling effort annually are spent on the Anchor River in the summer-fall period when steelhead are caught. Dolly Varden, coho salmon and steelhead are all caught during this period and it is not feasible to assign fishing effort to any one species. Total harvest of Anchor River steelhead has ranged from about 400 to 1,700 annually during the past 7 years. This catch has accounted for about 26 to 40% of the total combined harvest of steelhead in the State.

Steelhead stocks in all streams on the Kenai Peninsula are similar to those termed "summer run" throughout the Pacific Northwest. Adults enter the streams throughout the summer and fall, spend the winter in freshwater, then spawn the following spring and migrate back to sea.

Some aspects of Anchor River steelhead life history and population characteristics have been investigated periodically since the

Table 1. List of Common Names, Scientific Names and Abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Chinook salmon	Oncorhynchus tschawytscha (Walbaum)	KS
Coho salmon	Oncorhynchus kisutch (Walbaum)	SS
Dolly Varden	Salvelinus malma (Walbaum)	DV
Rainbow trout	Salmo gairdneri (Richardson)	RT
Steelhead trout	Salmo gairdneri (Richardson)	SH

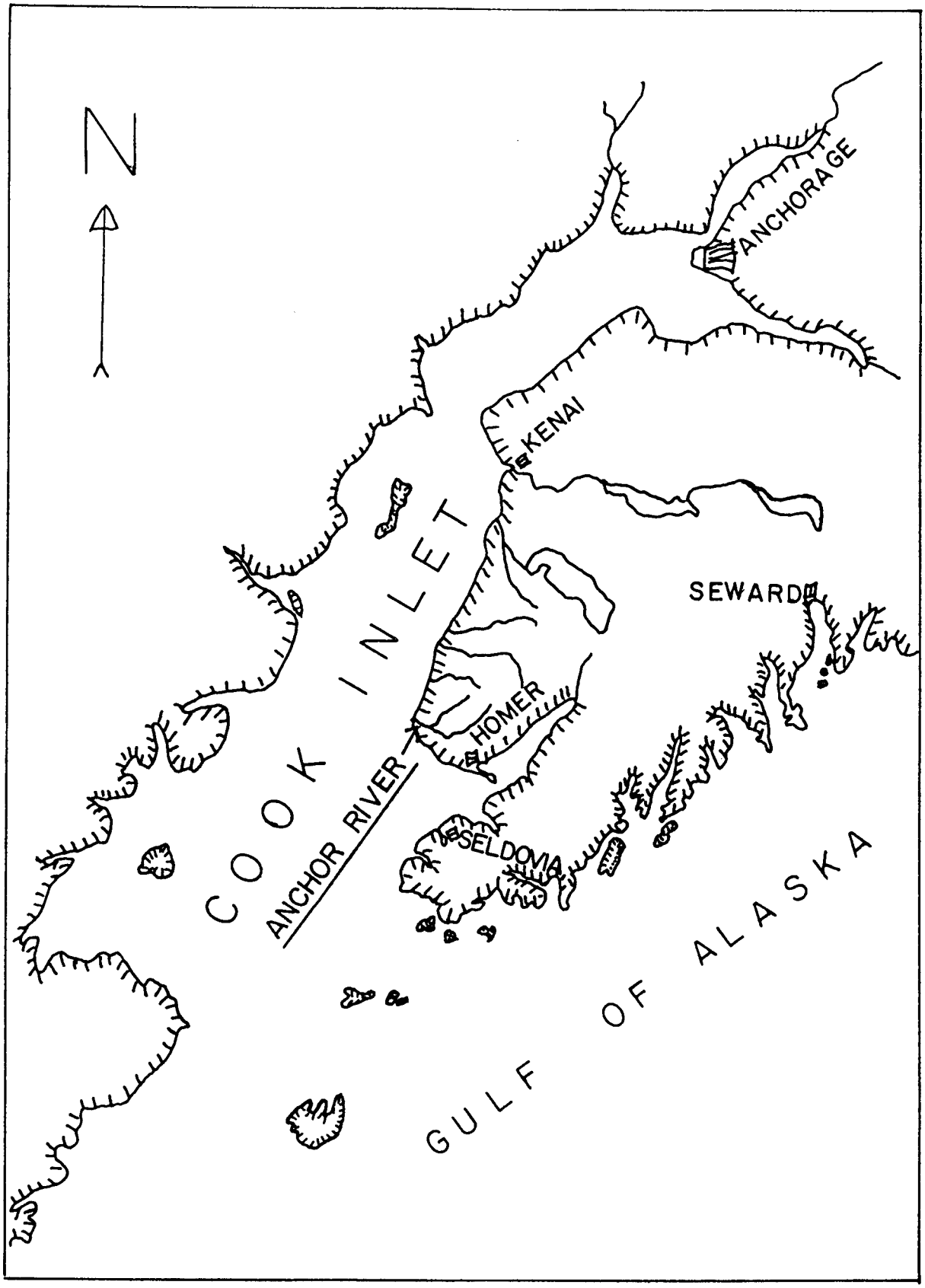

Figure 1. Vicinity map showing location of the study area.

mid-1950's, but the studies have been intermittent and of limited scope. Total run size, adult migration and spawning characteristics, areas and timing of juvenile rearing and migration and the potential for supplemental production area few important aspects which had not been studied adequately.

The stocks of steelhead are naturally produced at present. Future pressures on these stocks may require additional harvest restrictions or supplemental enhancement measures.

The Department's goal is to provide continued recreational angling for steelhead on these streams. Its concern was the lack of biological information upon which to base management programs, formulate regulatory guidelines and evaluate the need and potential for supplemental enhancement of these stocks. This study was initiated to meet these needs.

During the course of this investigation we compiled data which give us a far better understanding of the status of steelhead stocks in Anchor River, and of the instream movements of both juveniles and adults. However, there are two areas where our techniques are deficient:

1. The method of estimating total population of adult steelhead is of marginal value. We have been able to estimate total population in only 3 of the 6 years of the study, and confidence intervals of those estimates are great.

2. Methods of capturing steelhead smolts have been unsatisfactory, resulting in an incomplete assessment of the time of smolt migration and the size of smolts. The most useful data we have on these fish have come from scale analysis of adult steelhead.

RECOMMENDATIONS

1. The present objectives of this study should be retained and the study should be continued, however, its scope should be expanded to include other important salmonid species.

2. The study should be expanded to include steelhead population characteristics in other lower Kenai Peninsula streams.

OBJECTIVES

1. To determine size of steelhead stocks.

2. To determine instream behavior and intrasystem movement and migration.

3. To determine angler utilization and effects of current harvest levels.

4. To determine the need for supplementing steelhead stocks.

TECHNIQUES USED

Techniques reported by Wallis and Balland (1983) were used during the 1983 field season to: record water temperatures, obtain waterflow data, capture juvenile and adult steelhead, collect and interpret biological data, and conduct a creel census.

Juvenile salmonids were captured at several locations in addition to the five standard stations reported by Wallis and Balland (1983). Locations of all trapping stations are noted in Figure 2.

Four traps were operated during the period July 15 to August 5 in an attempt to capture newly-emerged steelhead fry. The traps, designed by project personnel as miniature inclined plane screen traps, measured 54 inches long, 18 inches wide and 19 inches high. They were placed immediately downstream of sites where adult steelhead had been observed spawning; two traps were fished in the South Fork and two in the North Fork.

On April 26 and May 6 radio transmitters were implanted subcutaneously into five adult steelhead by means of surgery. These fish were tracked by the same means and in conjunction with continued tracking of fish tagged in the fall of 1982, as reported by Wallis and Balland (1983).

Surveys of accessible areas of the North and South Forks of the Anchor River were conducted on foot from May 11 to June 15 to observe steelhead spawning areas. On June 7 the South Fork of Anchor River between Beaver Creek and Twitter Creek was surveyed by raft and on foot to observe steelhead spawning areas.

Steelhead were captured from Anchor River by ADF&G personnel for brood stock in a steelhead enhancement project. All fish were captured by gill net, otherwise techniques of capture and handling were the same as in 1982. Fish were transported to the Trail Lakes Hatchery for over-winter holding.

Samples of juvenile and adult salmonids were collected for pathological examination to determine if bacterial kidney disease, (Renibacterium salmoninarum), or Furnunculosis, (Aeromonas salmonicida), were present. Juvenile steelhead, coho and chinook were captured in minnow traps and frozen before shipment to the pathology laboratory in Anchorage. Kidney and hind gut samples from adult steelhead and coho were also collected, frozen and shipped to the pathology laboratory.

FINDINGS

Water Temperatures and Flows

Daily maximum and minimum temperatures recorded in the South Fork of the Anchor River are listed in Table 2.

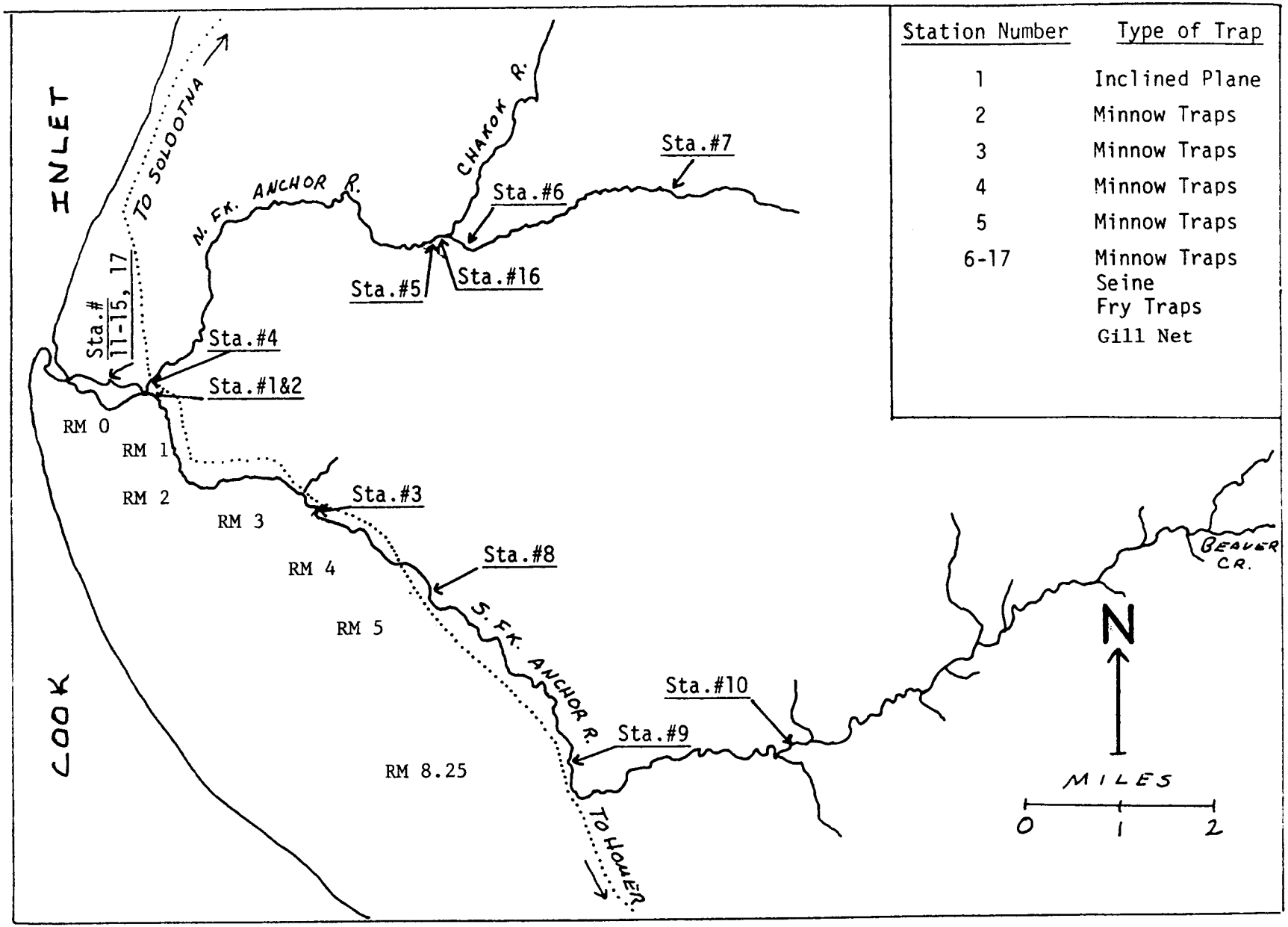

Figure 2. Map of Anchor River showing location of juvenile trapping stations, 1983.

Table 2. Minimum-Maximum Water Temperatures Recorded in the Anchor River, 1983, °C.

Day	May		June		July		August		September		October	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	...	...	7	9	11	15	...	...	11	11	5	5
2	...	...	7	11	11	16	...	...	9	12	5	5
3	...	...	8	11	11	17	...	...	10	11	4	5
4	...	...	8	12	12	12	...	14	8	10	2	4
5	...	...	7	13	10	16	14	16	6	9	3	4
6	...	...	9	14	11	13	12	15	6	10	3	4
7	...	...	9	14	11	13	12	14	6	10	1	3
8	...	...	10	13	11	12	12	13	7	9	0	2
9	...	...	9	12	11	13	10	14	7	10	1	2
10	...	...	9	14	10	13	10	14	6	10	2	4
11	...	...	8	11	10	12	11	14	6	10	4	4
12	...	...	9	11	11	13	11	14	7	9	3	4
13	...	...	9	12	11	15	12	15	7	9	2	3
14	...	...	9	13	12	17	11	15	6	8	1	2
15	...	...	10	13	13	17	9	14	5	7	2	2
16	...	...	9	14	14	17	9	14	4	7	2	3
17	...	...	9	15	13	18	11	15	3	7	2	3
18	...	...	10	16	12	18	10	15	4	5	2	3
19	...	9	12	14	12	18	9	15	5	6	2	2
20	5	9	10	12	13	15	10	12	5	6	2	3
21	6	8	9	14	12	15	11	12	6	8	2	2
22	5	7	10	16	11	...	11	13	6	8	2	2
23	5	7	11	14	...	...	9	13	5	7	1	2
24	5	7	11	12	...	...	11	14	3	5	0	1
25	5	9	11	13	...	...	10	12	2	4	0	0
26	6	9	11	12	...	...	9	11	0	3	0	0
27	6	8	11	13	...	...	8	13	1	3	0	0
28	6	9	11	13	...	...	9	13	3	4	0	0
29	7	9	11	15	...	...	10	13	4	5	0	0
30	8	9	12	14	...	...	11	13	5	6	0	0
31	7	9			...	...	10	14			0	0

Mean monthly waterflow rates in Anchor River for water years 1965-1982, inclusive, are depicted in Figure 3. Mean monthly flows during the 1983 water year are shown by the broken line in Figure 3.

Juvenile Data

Juveniles Trapped:

Specific locations of the various trapping stations are noted in Figure 2. A summary of the numbers of juveniles of different species trapped is presented in Table 3.

The inclined plane trap at Station 1 was not effective in trapping fish of any species; due to low water flows, the trap fished intermittently throughout the period.

Size distributions of juvenile steelhead captured at Stations 2, 3, 4 and 5 are presented in Tables 4, 5, 6, and 7, respectively. Juveniles were trapped at other sites where minnow traps were fished intermittently. There were no obvious differences in size between fish caught at these miscellaneous sites and at the established stations.

The length-relationship of juvenile steelhead captured during 1983 is presented in Figure 4.

In previous years, data were presented to show that steelhead smolts were fish 130 mm in length and larger. Data in Tables 4-7 show there were comparatively few smolt-sized fish trapped, and no apparent pattern is evident to suggest a time of migration or the size distribution of smolts.

During July, Dolly Varden were captured in a small mesh gill net in the lower sections of Anchor River for a tagging study. A total of 18 steelhead smolts were captured in this operation during the period July 11-20 from the Dudas Hole to the intertidal area. These fish ranged in length from 158 to 210 mm and averaged 189 mm. This is substantially larger than the calculated mean sizes of steelhead smolts in earlier years; it is likely that the gill net was selective for larger fish.

Juveniles Tagged:

A total of 591 juvenile steelhead were tagged with plastic flutter tags to determine the extent to which they move from one area of the stream to another. During most of the season only those juveniles ranging from 80 to 129 mm in length were tagged, but after August 24 smolt-size fish, 130 mm and greater, were also tagged. A summary of tagging and recovery data is presented in Table 8.

One fish tagged at Station 4 on the North Fork was recaptured 34 days later at Station 3 on the South Fork; the fish had moved downstream out of the North Fork, then upstream approximately 3 miles in the South Fork. All other tagged fish were recaptured at the location where they had been tagged, and recapture occurred from 1 to 142 days after tagging.

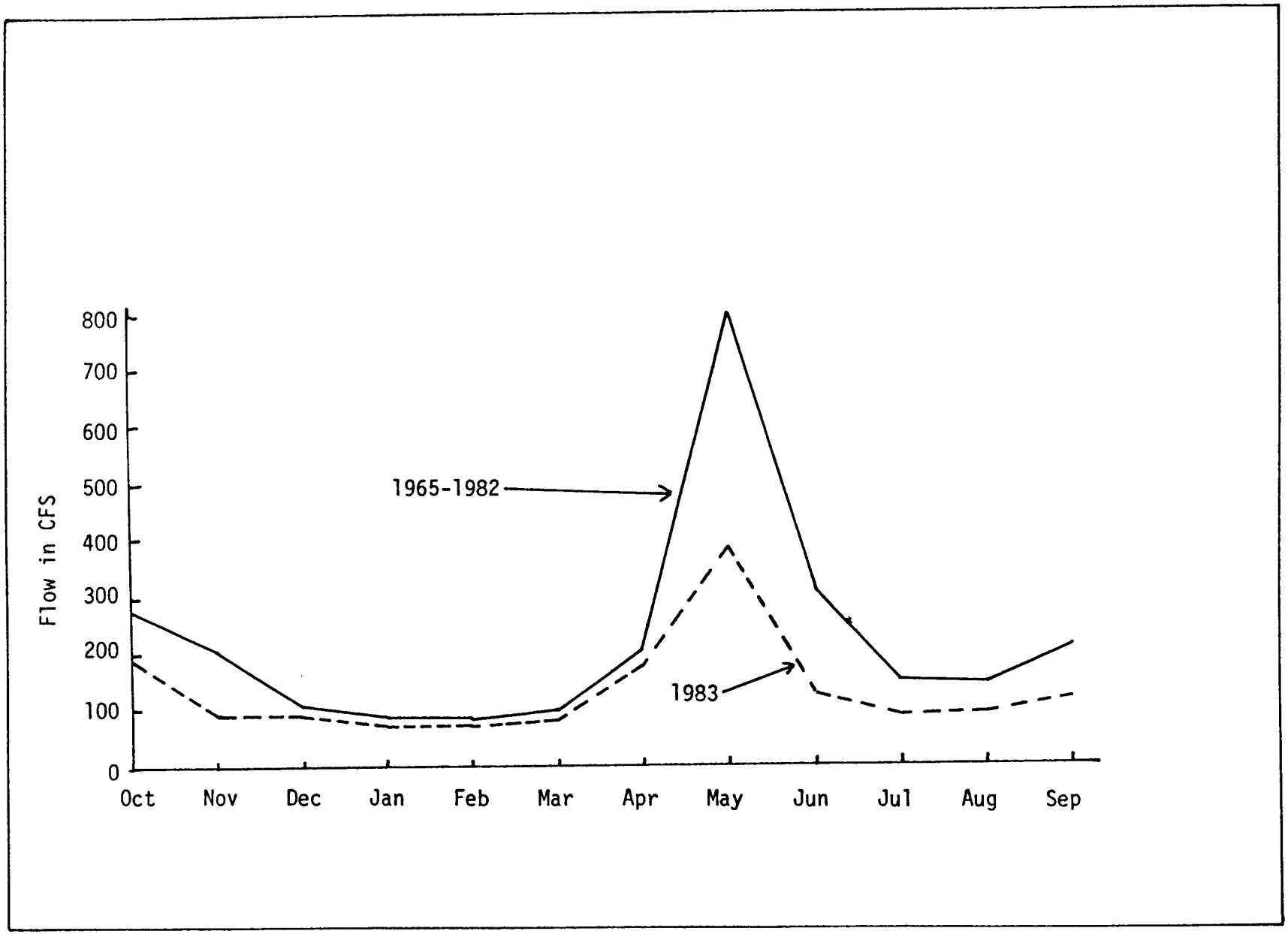

Figure 3. Mean monthly waterflows in Anchor River, 1965-1983.

Table 3. Summary of Numbers of Juvenile Salmonids Captured at Various Trapping Stations in Anchor River, 1983.

Station Number	Type of Trap	SH	DV	KS	SS
1	Inclined Plane	18	1	82	200
2	Minnow Traps	555	396	371	1,779
3	Minnow Traps	308	419	762	743
4	Minnow Traps	265	292	746	1,290
5	Minnow Traps	604	595	650	963
Miscellaneous Stations	Minnow Traps Seine, Gill Net, Inclined Plane Fry Trap	244	182	283	247
	Total	1,994	1,885	2,894	5,222

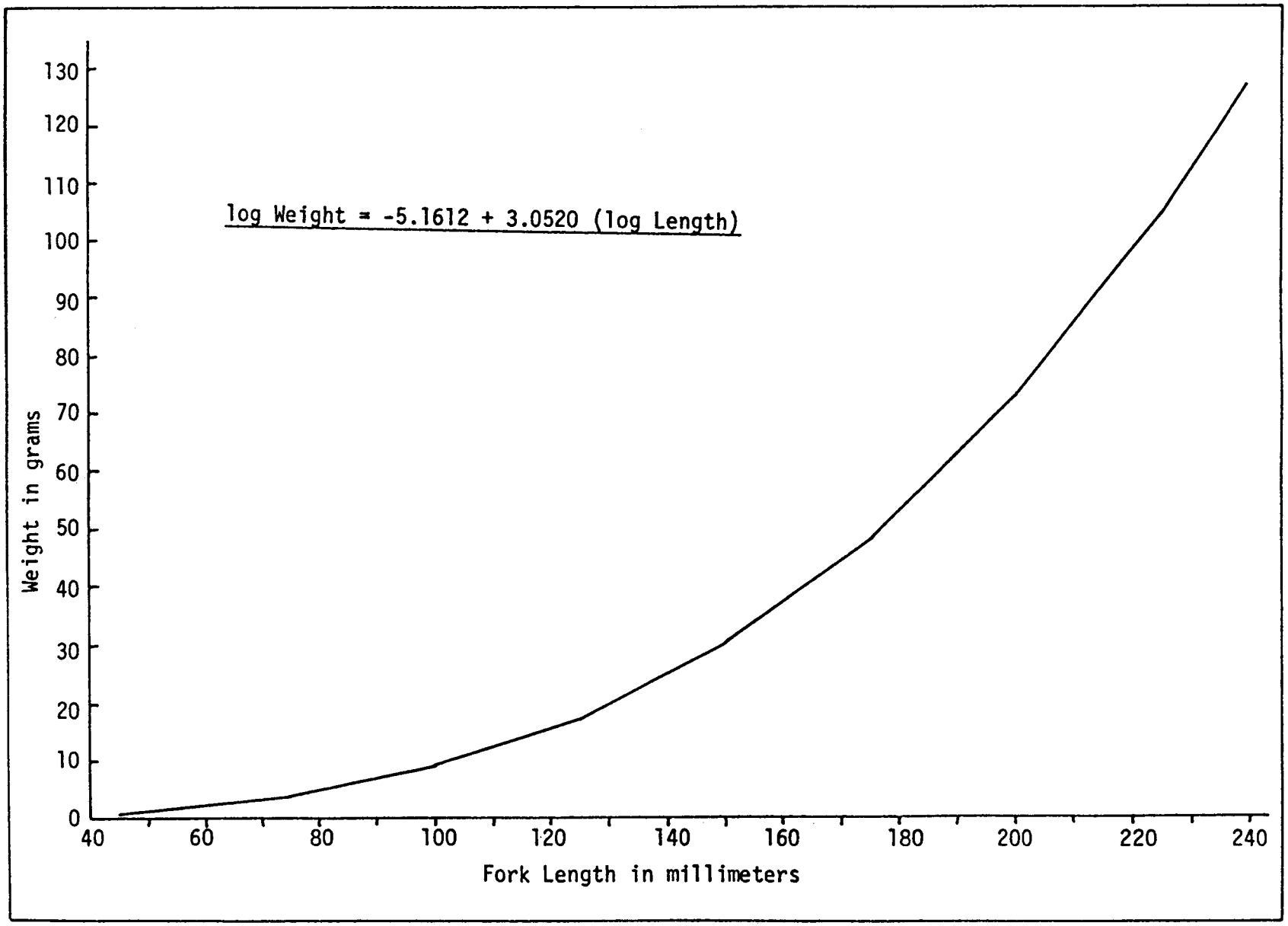

Figure 4. Length-weight relationship of juvenile steelhead in Anchor River, 1983.

Table 4. Numbers of Juvenile Steelhead Trapped at Station 2 in Anchor River, by Weekly Period and Length Interval, 1983.

Fork Length	Week Ending 5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29
25- 29										1															
30- 34																									
35- 39			1																						
40- 44													12	10	3	3	1								
45- 49			1										5	21	6	3	1	2	1			2		1	2
50- 54		1	5										1	5	7	7	12	2	2	1		4	4	4	3
55- 59	2	7	10					1							2	6	8	6	9		3	14	1	2	2
60- 64	2	11	4	2		1	4	1							1	1		6	11	3	2	11	1	1	4
65- 69	2	2	4	1		1	1	1									1		1		1	9	2		2
70- 74							5	2	2	2												2			
75- 79						2	1	1	2	3		1													
80- 84						1	1	4	3	4	2			2											
85- 89	1		1				2	1	5	3	1	2		2			1								
90- 94			1				2		3	3		2	1		1	1	1					1	1		
95- 99	1						1		1	2	1	5		3	2	1	3	1				1	1		
100-104	3	2						1	3	3		2	1	2	2	2	1	1	1			2			
105-109			1						1	1		2	1		2		2		2			1			
110-114							1	1	1			1			4	2	4	2			1	4	1		1
115-119							1	1			1					1	1				1	3		1	1
120-124							1	1	1		1	1			3	1		1				2		1	
125-129						1	1	1						1	1	1	1	1	2					1	
130-134		1					2	1			1	1	1				2	1	1						
135-139	1									1	1					1	1	2	1						
140-144	1								1					1					1		1				
145-149	1											1				1								1	
150-154																			1		1				
155-159																									1
160-164						1										1									
165-169																									
Total	14	24	28	3	0	7	23	17	23	23	8	18	22	47	34	32	40	25	33	4	10	56	11	12	16

Table 5. Numbers of Juvenile Steelhead Trapped at Station 3 in Anchor River, by Weekly Period and Length Interval, 1983.

Fork Length	Week Ending 5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29
45- 49														3	1		2	1							
50- 54		1	1			1							1	1	4	3	8			2					
55- 59		1	5											2	2	1	8	1	2	2	1	2			
60- 64			3				2							1	1		1	3	3	1	1	3			
65- 69						1	3	2				1													2
70- 74							1				1		1												
75- 79			1				2	4	1	7	1			1	1		1	3							
80- 84			1				1		5	10			2	1		1			1						
85- 89		2		1				1	5	7	1	1	3	3		1	1								
90- 94		4	1						1	7			1	4		4	2						1		
95- 99		4					1		1	5			6		1	1	2		1			6			
100-104		4		1					1				3	1	4	2	4	2	2			4			1
105-109		1				1	1		1	1			1	1		1	3		1			2			1
110-114		1				1			1	2						1	2	1	1			2		2	
115-119		1							2	3				1		1									
120-124									2						1							1			
125-129		1					1			1				1								1			
130-134															1							2			
135-139	1									1				1											
140-144														1								2			
145-149														1	1	1						1			
150-154																1.									
155-159																		1							
160-164																						1			
Total	1	20	12	2	0	4	12	7	20	44	3	2	18	23	17	18	34	12	11	5	2	27	1	2	4

Table 6. Numbers of Juvenile Steelhead Trapped at Station 4 in Anchor River, by Weekly Period and Length Interval, 1983.

Fork Length	Week Ending 5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29
45- 49			1										3	1	1		1								
50- 54		3											1	3	3	3	4	3	1	1	2	1		1	
55- 59		4	1												1	1	5	3		1		1	3	2	1
60- 64		5	2			4												2			4	1	1	3	1
65- 69		3		1		4											2	1	1	3		1	1		
70- 74		1				2		2	1	1	1											1		1	
75- 79						2	1	4	3	6	3			1					1						
80- 84		1	2				3	4	2	3	1			2	2	1						2			
85- 89								1	2	3	2	2		2	2	1							2		
90- 94		2					1	1		3	5	1		1	3	4								2	
95- 99								1		1		1		2	1									1	
100-104		1					1				2				1	1					1				
105-109		1				1			1	1			1		4								1		
110-114	1	2							1	1								1				1			
115-119							1	1		1			1											1	
120-124			1						2						1										
125-129								1					1												
130-134	1							2						1		1		1					1		
135-139														1		1									
140-144			1																						
145-149			1												1										
150-154																1									
155-159								1																1	
160-164																			1						
165-169																									
Total	2	23	9	1	0	13	7	18	12	20	14	4	7	14	20	14	12	11	4	5	7	8	9	12	2

Table 7. Numbers of Juvenile Steelhead Trapped at Station 5 in Anchor River, by Weekly Period and Length Interval, 1983.

Fork Length	Week Ending 5/14	5/21	5/28	6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29
30- 34													1												
35- 39																									
40- 44														1											
45- 49		3	3			2								3	10	6	6	3	3	1		5			4
50- 54	1	10	1	2	1	2			1					1	9	12	22	6	5		2	13	2	2	1
55- 59	2	20	7	2		1	3								2	2	11	2	4	1	6	13	5	1	7
60- 64		5	4	2		10	6		1		3								2		1	9		1	2
65- 69			1			2	15	6	2	3			2									1			
70- 74		2	1			1	7	5	7	2	4	1	2												
75- 79		5	2				1	3	4	5	5		6	1	2	2	1	1					1		
80- 84	1	4	3	1		1			2	2	6		5	3	5	1	3		1	1		3			
85- 89	1	7	1			1					2		4	5	1	3	2				4				
90- 94		3				2				1	3		4	2		5	3	1	1						
95- 99	1	1	1			1							3	1	1	1	6	1	1		1	2			
100-104	1	1				1	1			1	1		2	1	2	1	8					1	1		
105-109							1		1						1	2	1		1	1					
110-114		1	1							1									1					2	
115-119													1				2	1							
120-124													1			1	1		1	1					
125-129	1	1													1		1		1						
130-134														1					1				1		
135-139		2											1	1			1		2						
140-144																			1			1			
145-149							1							1					1				1		
150-154															1	1	2		1						
155-159			1																						
160-164																	1								
165-169																									
170-174																			2						
175-179																1									
Total	8	65	26	7	1	24	35	14	18	15	24	1	32	21	35	38	71	15	29	5	14	48	11	6	14

A comparison of lengths of fish at time of tagging and time of recapture provided information on growth of individual fish. The increase in length of several individual fish is illustrated graphically in Figure 5. The point at the beginning of each line represents the size at time of tagging and the second point the size at recapture.

Mean weekly water temperatures during the period are also plotted in Figure 5. The changes in growth rate as depicted by the slope of the lines are closely related to water temperatures; i.e., flatter slopes representing slow growth occur during lower temperatures, and steeper slopes illustrating more rapid growth are evident during higher temperatures.

Emergent Fry Data:

Traps were fished in different locations in an attempt to determine the size of emergent steelhead fry and their time of emergence. The sites selected were those where steelhead had been observed spawning.

A summary of numbers and sizes of emergent fry at each site is presented in Table 9. Fry were trapped at two of the sites as soon as traps were installed, therefore the earliest emergence was missed. However, peak catches of emergent fry occurred at all three sites during the week ending July 23, then gradually declined into early August.

Adult Data

Population Estimates:

During the period August 22 to October 24, 133 adult steelhead were tagged with serially numbered Floy anchor tags and released. The purpose of these tags was to provide data to estimate the steelhead population in Anchor River.

Anglers reported 22 tagged fish were recaptured and ADF&G personnel recaptured 21 during gill net operations. Fish were recaptured from 0 to 60 days after tagging. Five steelhead were recaptured twice after they had been tagged and one was recaptured three times. Ten fish were recaptured at the same location where they had been tagged. Other fish were recaptured both upstream and downstream from the site of tagging. The greatest distance of movement from site of tagging to site of recapture was approximately 3 river miles. The most rapid movement of tagged fish was approximately 1 river mile in 1 day, and slowest movement was 0.2 river miles in 60 days.

Eight tagged fish were recovered during creel census sampling and provide a basis for estimating the total population. Using the Peterson method as modified by Chapman (Ricker, 1975), it was estimated that the total population of steelhead in Anchor River in 1983 was 1,682 fish.

Radio Telemetry Studies:

Twenty-one adult steelhead were tagged by insertion of radio transmitters into the abdominal cavity in the fall of 1982 (Wallis and

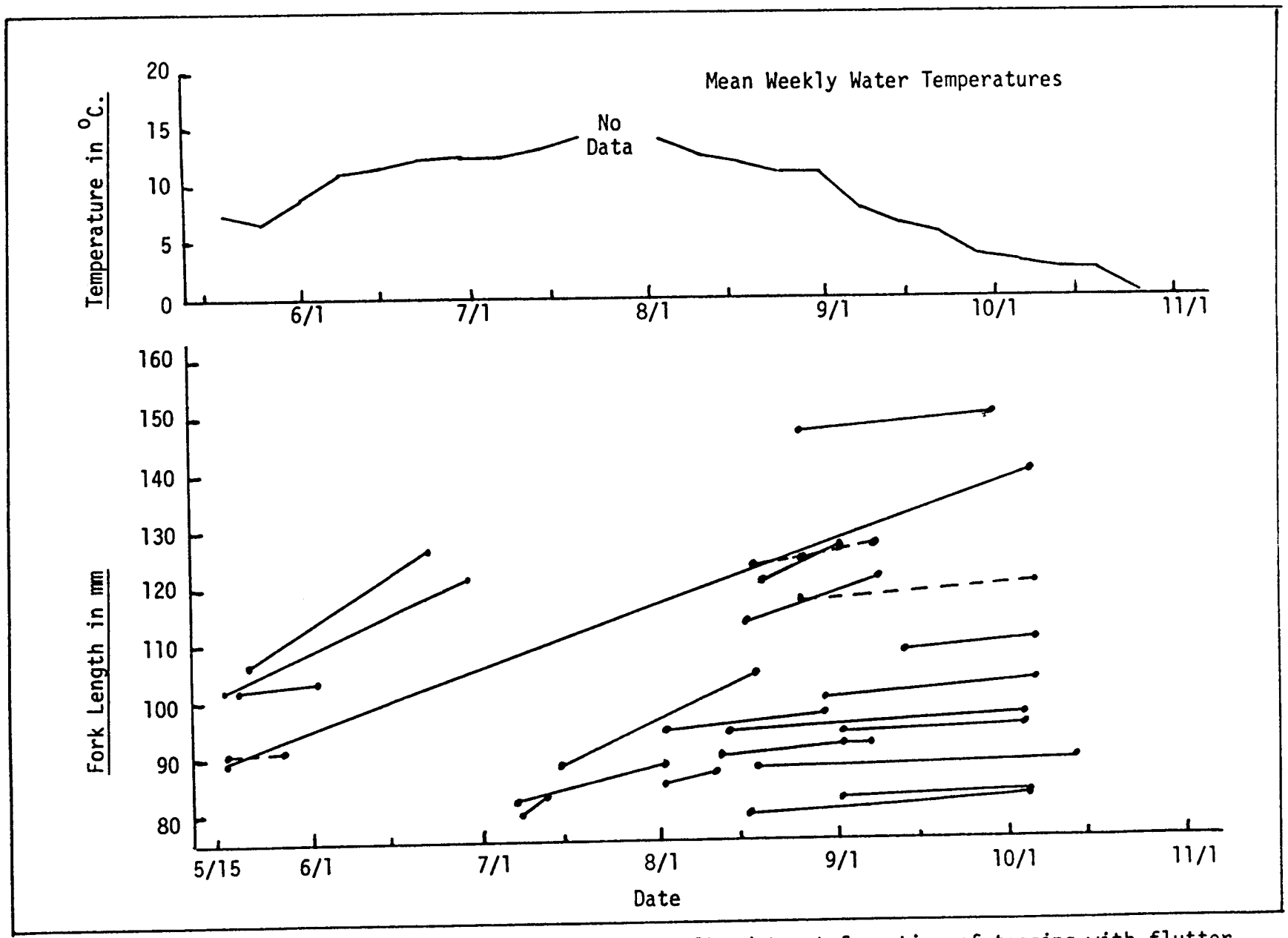

Figure 5. Increase in length of individual juvenile steelhead trout from time of tagging with flutter tags until recaptured, Anchor River, 1983.

Table 8. Numbers of Juvenile Steelhead Tagged with Flutter Tags and Numbers Recaptured in Anchor River, 1983.

	Station				
	2	3	4	5	Total
Number Tagged	164	161	100	166	591
Number Recaptured Once	10	10	7	13	40
Number Recaptured Twice	1	0	0	2	3
Number Recaptured at Another Station	0	0	1*	0	1
Total Recaptured	11	10	8	15	44

* One fish recaptured at Station 3.

Table 9. Numbers of Emergent Steelhead Fry Captured in Inclined Plane Screen Traps in Anchor River, 1983.

Station 6. North Fork Anchor River

Length Interval	Week Ending 7/16	7/23	7/30	8/6
25-29	2	11	0	0
30-34	3	41	4	2
35-39	0	0	1	1
Total	5	52	5	3

Station 8. South Fork Anchor River

Length Interval	Week Ending 7/16	7/23	7/30	8/6
25-29	5	2	2	0
30-34	13	15	8	3
35-39	0	4	2	4
Total	18	21	12	7

Station 16. North Fork Anchor River

Length Interval	Week Ending 7/16	7/23	7/30	8/6
25-29	0	3	0	0
30-34	0	10	1	1
35-39	0	0	1	0
Total	0	13	2	1

Balland, 1983). Their movements were monitored periodically throughout the winter and spring of 1983. A list of fish tagged, with pertinent tagging and tracking data is presented in Table 10.

The following list summarizes the dispostion of the 21 fish tagged in September and October 1982:

3 fish were caught by anglers from 3 to 10 days following tagging;
4 fish disappeared immediately;
1 fish disappeared after 1 day;
1 fish disappeared after 20 days;
2 fish were tracked for 128 and 188 days, then signals were lost;
3 fish were known to be dead after 2 to 17 days;
1 fish known to be dead after 141 days; and
6 fish were tracked through the spawning period in May and June 1983.

Fish which were tracked throughout the period remained in the same general areas reported by Wallis and Balland (1983) until late April or early May. One exception was Fish Number 13 which moved several miles upstream in mid-March. Figures 6 and 7 are graphic representations of movements of five of the fish from time of tagging until the final radio signals were received. The overwinter holding areas and apparent spawning areas of fish tracked throughout the holding and spawning periods are illustrated in Figure 8.

There were significant differences in movements by individual fish and they will be discussed separately.

Fish No. 5. In the fall of 1982, this fish showed the downstream-upstream movement typical of most of the tagged fish (Figure 6). It went upstream as far as river mile (RM) 1.5, then in early November to RM 0.7-1.0 immediately below the bridge, and remained in that area through April 1983. In early May, the fish dropped downstream to RM 0.3 where it remained until the signal was last heard on June 2, 1983. It is assumed the fish spawned in the area during May.

The fish was recaptured by an angler on September 22, 1983 at RM 3.0 on a repeat spawning run. The angler returned the radio and Floy anchor tag number 003618. The anchor tag had been attached on September 14, 1983 at RM 0.6; the Peterson disc tag had been lost. There was no comment on unusual condition of the fish when it was tagged with the Floy tag.

Fish No. 7. After the initial downstream-upstream movement, this fish remained in the area of RM 1.5-1.8 from October 7, 1982 to April 27, 1983, then the signal was lost. Aerial flights were made periodically in an attempt to locate missing radio signals, and some of these flights covered areas of Stariski Creek, Deep Creek and Ninilchik River, as well as areas of the Anchor River drainage not accessible from the road system. Signals from Fish No. 7 were detected in Stariski Creek during one of these flights on May 12. Its location was confirmed on the ground the following day.

Table 10. List of Anchor River Steelhead Tagged With Radio Transmitters in 1982-1983.

Fish No.	Date Tagged	Sex	Length (mm)	Radio Frequency	Peterson Tag No.	Remarks
1	9/22/82	M	690	150.365	A 187	Caught by angler 10/2/82. Radio re-used in Fish No. 12.
2	9/22/82	F	880	150.285	A 188	Disappeared after 20 days.
3	9/22/82	M	590	150.144	A 189	Fish died. Radio found 6/28/83. Last known movement 2/10/83.
4	9/22/82	F	740	150.416	A 190	Disappeared immediately.
5	9/23/83	M	585	150.306	A 184	Radio tracked until 6/2/83. Radio returned by angler who caught fish on 9/22/83 on return spawning run.
6	9/23/82	F	690	150.246	A 186	Fish died. Radio found 10/20/82; re-used in Fish No. 23.
7	9/23/82	M	675	151.863	A 185	Radio tracked until 6/6/83. Fish apparently spawned in Stariski Creek and returned to sea.
8	9/23/82	F	580	150.015	A 191	Caught by angler 9/26/82. Radio re-used in Fish No. 13.
9	9/23/82	M	610	150.041	A 461	Radio tracked until 6/10/83. Fish apparently spawned in Chakok River, then moved downstream into Anchor. Tag returned by angler on 6/11/83, but radio not returned.
10	9/23/82	F	835	150.127	A 463	Caught by angler 10/2/82. Radio not returned.

Table 10 (cont.). List of Anchor River Steelhead Tagged With Radio Transmitters in 1982-1983.

Fish No.	Date Tagged	Sex	Length (mm)	Radio Frequency	Peterson Tag No.	Remarks
11	9/23/82	M	730	150.186	A 464	Radio tracked until 3/30/83, then disappeared. Suspected that fish did not spawn.
12	10/5/82	F	660	150.364	A 177	Disappeared immediately.
13	10/5/82	F	815	150.015	A 178	Radio tracked until 6/6/83. Suspected that fish spawned in middle section of So. Fk. Anchor River.
14	10/5/82	M	750	150.343	A 176	Disappeared immedilately.
15	10/5/82	F	610	151.824	A 175	Radio tracked until 7/11 and found on sand bar in Chakok R. Suspected that fish spawned in Chakok R. then was caught by predator.
16	10/5/82	F	775	151.833	A 181	Fish died. Radio found 5/4/83. Fish suspected dead immediately. Radio re-used in Fish No. 25.
17	10/5/82	M	630	150.273	A 182	Radio recovered from live, spent fish on 6/10/83.
18	10/5/82	F	710	150.202	A 465	Fish died. Radio found 10/20/82; re-used in Fish No. 22.
19	10/5/82	M	610	151.722	A 466	Radio tracked until 2/10/83, then disappeared.
20	10/5/82	F	715	150.223	A 467	Disappeared immediately.
21	10/5/82	M	765	150.293	A 468	Disappeared after 1 day.

Table 10 (cont.). List of Anchor River Steelhead Tagged With Radio Transmitters in 1982-1983.

Fish No.	Date Tagged	Sex	Length (mm)	Radio Frequency	Peterson Tag No.	Remarks
22	4/26/83	F	700	150.202	A 469	Radio recovered 6/28/83. Out of fish.
23	4/26/83	M	600	150.244	A 470	Radio and fish recovered 5/31/83. Radio fell out when fish was captured.
24	4/26/83	F	690	150.323	A 471	Radio recovered 6/28/83. Out of fish.
25	5/6/83	F	610	161.833	A 472	Radio tracked until 6/2/83, then disappeared.
26	5/6/83	F	695	150.482	A 473	Radio recovered 6/10/93. Out of fish.

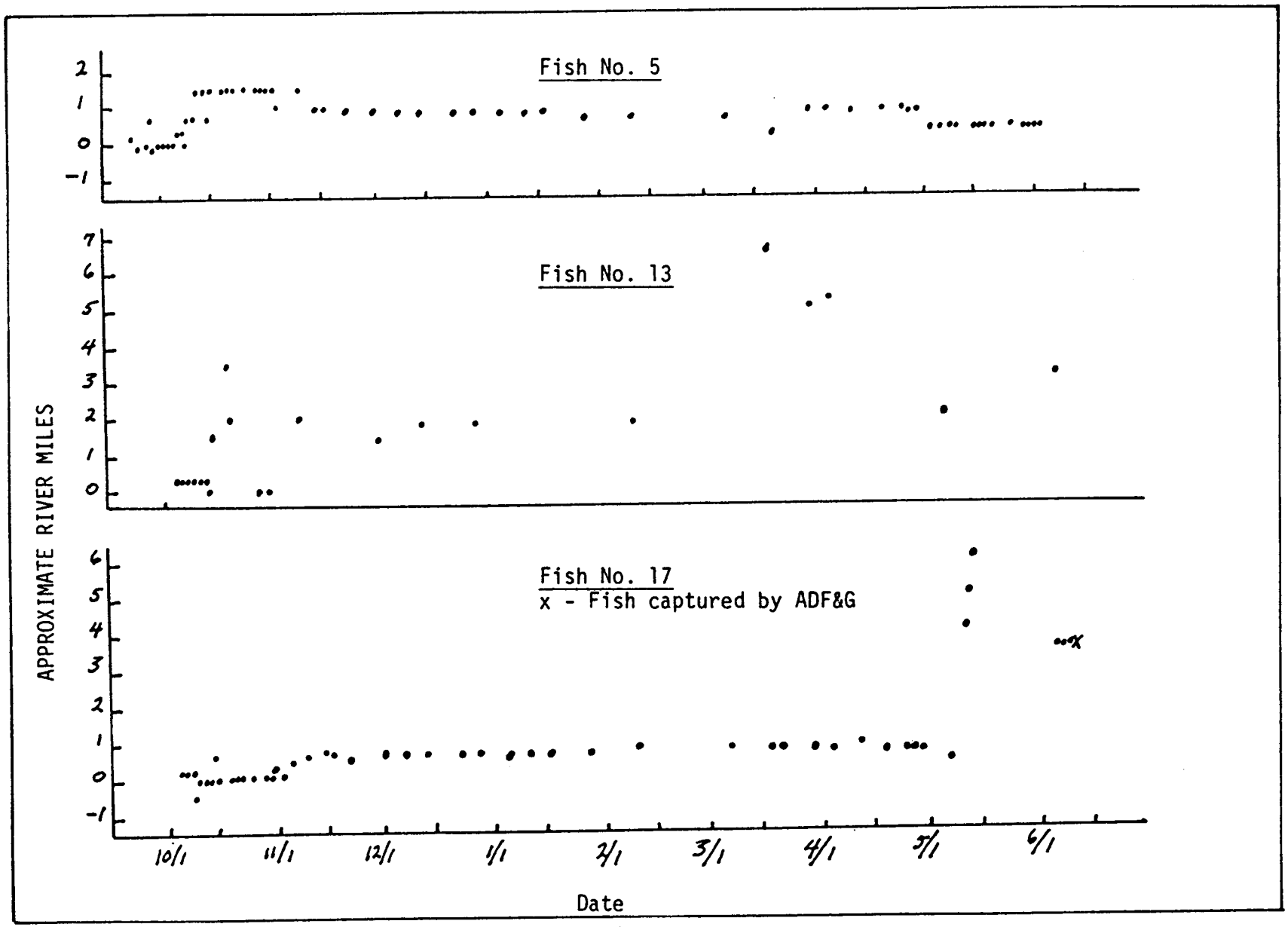

Figure 6. Graphic illustration of movement of radio-tagged steelhead in Anchor River, 1982-1983. Fish Numbers 5, 13 and 17. (Each dot represents positive signal locations).

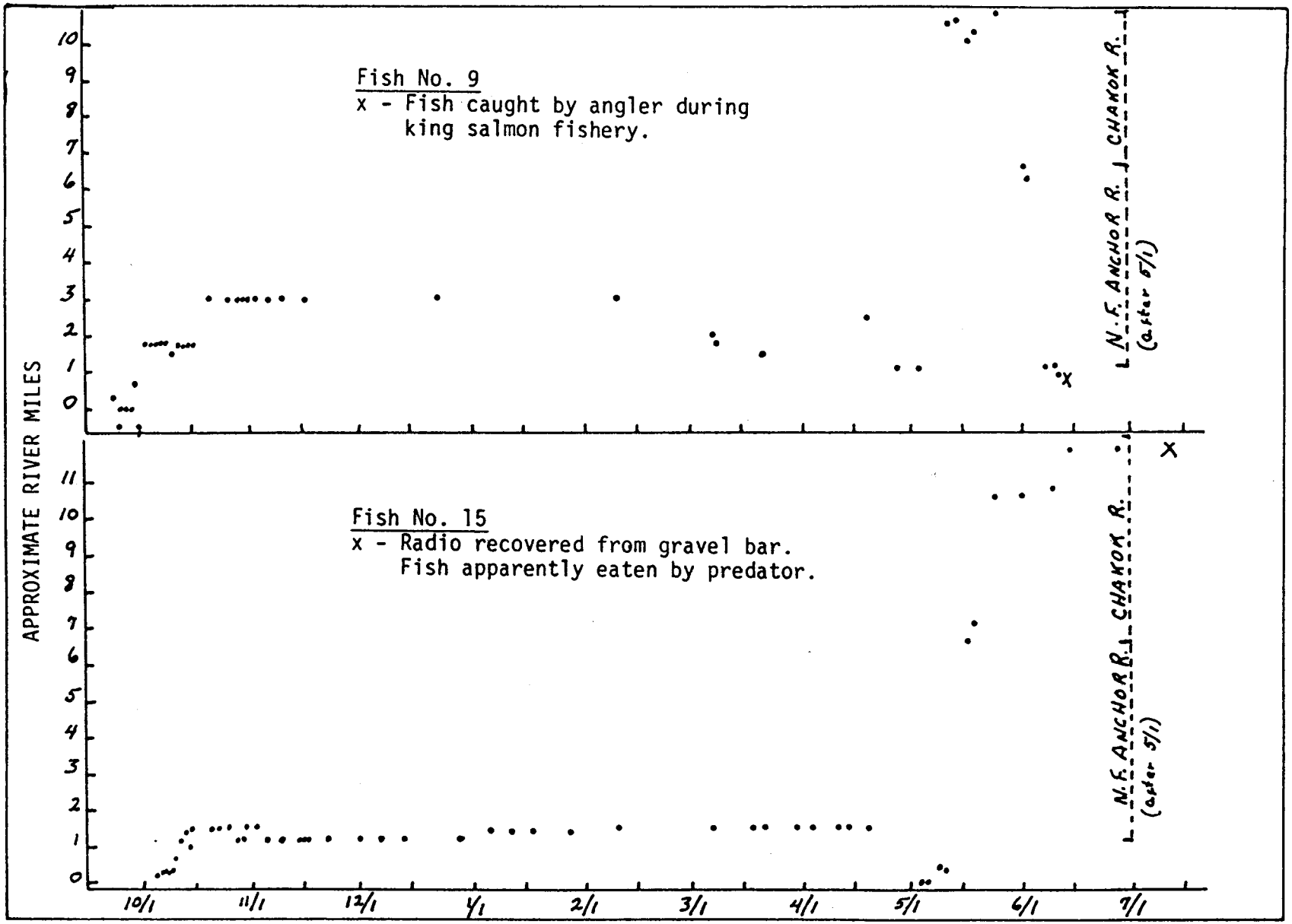

Figure 7. Graphic illustration of movement of radio-tagged steelhead in Anchor River, 1982-1983. Fish Numbers 9 and 15. (Each dot represents positive signal location).

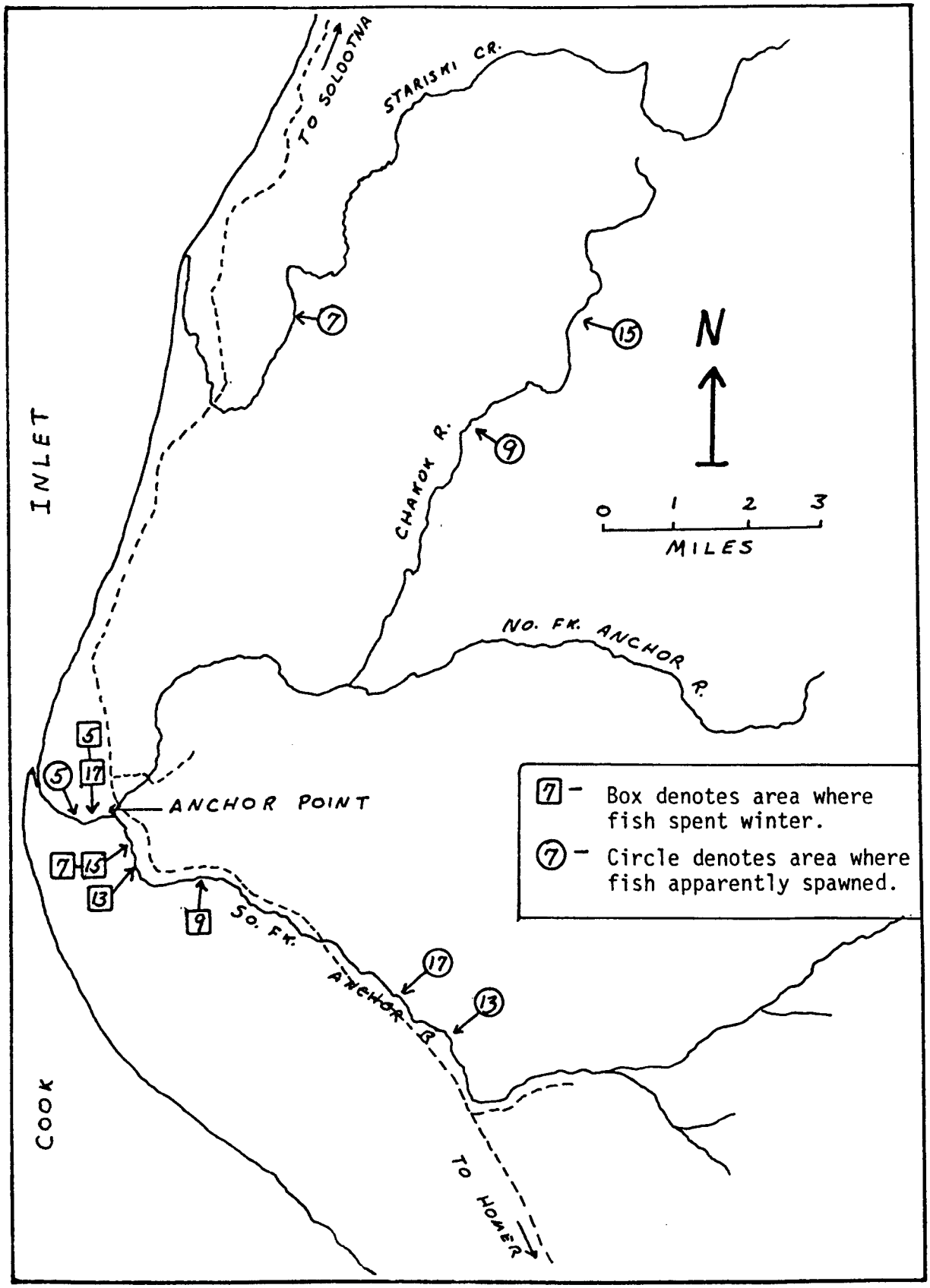

Figure 8. Overwintering areas and apparent spawning areas of radio-tagged steelhead in Anchor River, 1982-1983.

After spending the winter in Anchor River, it dropped downstream approximately 2 miles to saltwater in Cook Inlet, went up Cook Inlet approximately 7 miles to Stariski Creek, then approximately 4 miles up the creek to its apparent spawning grounds.

The fish remained in the same area during the period May 12 to June 2; it was recorded approximately 1½ miles downstream on June 6, and by June 8 could not be detected. It is presumed the fish had returned to sea.

Fish No. 9. Signals from this fish were received intermittently, as indicated by the paucity of observations during the period December 1982 to April 1983 in Figure 7. Our best estimate of its location is that it remained in the Powerline Hole area (RM 3.0) throughout the winter.

In late April, the fish moved downstream to the Forks (RM 1.1) and remained there a few days; within a week it moved up the North Fork Anchor River and several miles up the Chakok River. It remained in the same general area from May 12 through May 24; it is presumed to have spawned during that period. On May 31 it had moved downstream to the North Fork Anchor, by June 8 was at the Forks and on June 10 was located at the bridge on the main Anchor River. A signal was not detected on June 13, and it was presumed the fish had returned to sea. In October 1983, however, a Division of Parks employee turned in the Peterson disc tag and reported it had been given to him by an angler during the chinook salmon fishery in the spring. The radio was not returned and no precise date was given, but the chinook salmon season had been open on the weekend of June 11-13, when the signal disappeared.

Fish No. 13. This was the second fish for which signal reception was intermittent (Figure 6), but our opinion is that it spent the winter near RM 2. In March, it moved upstream to RM 6.5. Signals received were strange and intermittent after that time. It is presumed it spawned near the area of uppermost migration, but poor signal reception makes this a questionable assumption.

Fish No. 15. This fish wintered above the Forks at RM 1.5, dropped downstream to the intertidal area in early May 1983, then migrated up the North Fork Anchor River and several miles up the Chakok River (Figure 7). It stayed in one area from May 20 to June 10; then the signals moved upstream and remained stationary.

The radio was recovered from a gravel bar on July 11. The radio had tooth marks on it, and it is speculated the last upstream movement was by a predator.

Fish No. 17. This fish remained in the Cottonwood Hole (RM 0.7) throughout the winter, then moved upstream to RM 6 in early May (Figure 6). Signals were not heard for several days, then it was discovered at RM 3.5 on June 6. The fish was caught with a gillnet by ADF&G personnel on June 10, and killed for examination.

The fish was a male and completely spent. Externally, the body was in fair shape for a spent fish. Abrasions from the Peterson disc tag were the most obvious damage to the fish. The incision where the transmitter

had been inserted was well healed with a visible scar. Adhesions had grown around the transmitter and antenna wire, and the unit was securely in place in the body cavity.

Subcutaneous Implants. On April 26 and May 6, 1983, five steelhead were captured immediately below the bridge on Anchor River (RM 1.0) and tagged with transmitters implanted beneath the skin. We thought it would be inadvisable to open the abdominal cavity because of the advanced stage of sexual maturity of the fish. Pertinent tagging data and remarks for these fish are also included in Table 10.

Fish No. 22 moved upstream from the tagging site within 3 days and moved relatively rapidly to approximately RM 9.0. The other four fish remained near the tagging site for periods ranging from 14 to 20 days before they made a noticeable upstream migration. Fish No. 23 went up the North Fork Anchor River while the other four fish moved varying distances up the South Fork.

The tagging site and the uppermost migration of these five fish are illustrated in Figure 9.

Fish No. 23 moved 1.75 miles up the North Fork in mid-May, then on May 24 was noted approximately 1 mile downstream from its previous location. In anticipation that it may have spawned and was on its way back to sea, it was captured on May 31 for examination. As the fish was netted from the river, the radio fell out.

The fish was a male, and while it had some free-flowing milt, it had not spawned. The skin that had been separated from the musculature to form a pocket for the transmitter had decayed to allow the radio to fall out.

Transmitters from Fish Nos. 22, 24 and 26 were found in the river out of the fish. We do not know whether any of these fish spawned, nor do we know if the uppermost location was their ultimate destination. The tracking data appear to be adequate to define the time that steelhead leave their overwinter holding area to migrate to spawning areas. However, the implantation technique was poor because the skin decayed allowing radios to fall out. In addition, Fish No. 23 was dropping downstream without having spawned; it was very lethargic, suggesting it was in poor health.

Creel Census:

A creel census of the summer-fall fishery was started on August 13 and terminated on October 30. A total of 2,701 anglers were interviewed and completed anglers fished an average 3.44 hours per day. Total angler effort during this period was estimated to be 6,941 man-days.

Angler effort prior to September is concentrated on coho salmon. Coho populations have been high in recent years, and angler effort has also been high during the coho runs. The coho run was not as great this year and angler effort directed toward coho was less than it had been in recent years. Angler effort during September and October is comparable to estimated effort in previous years.

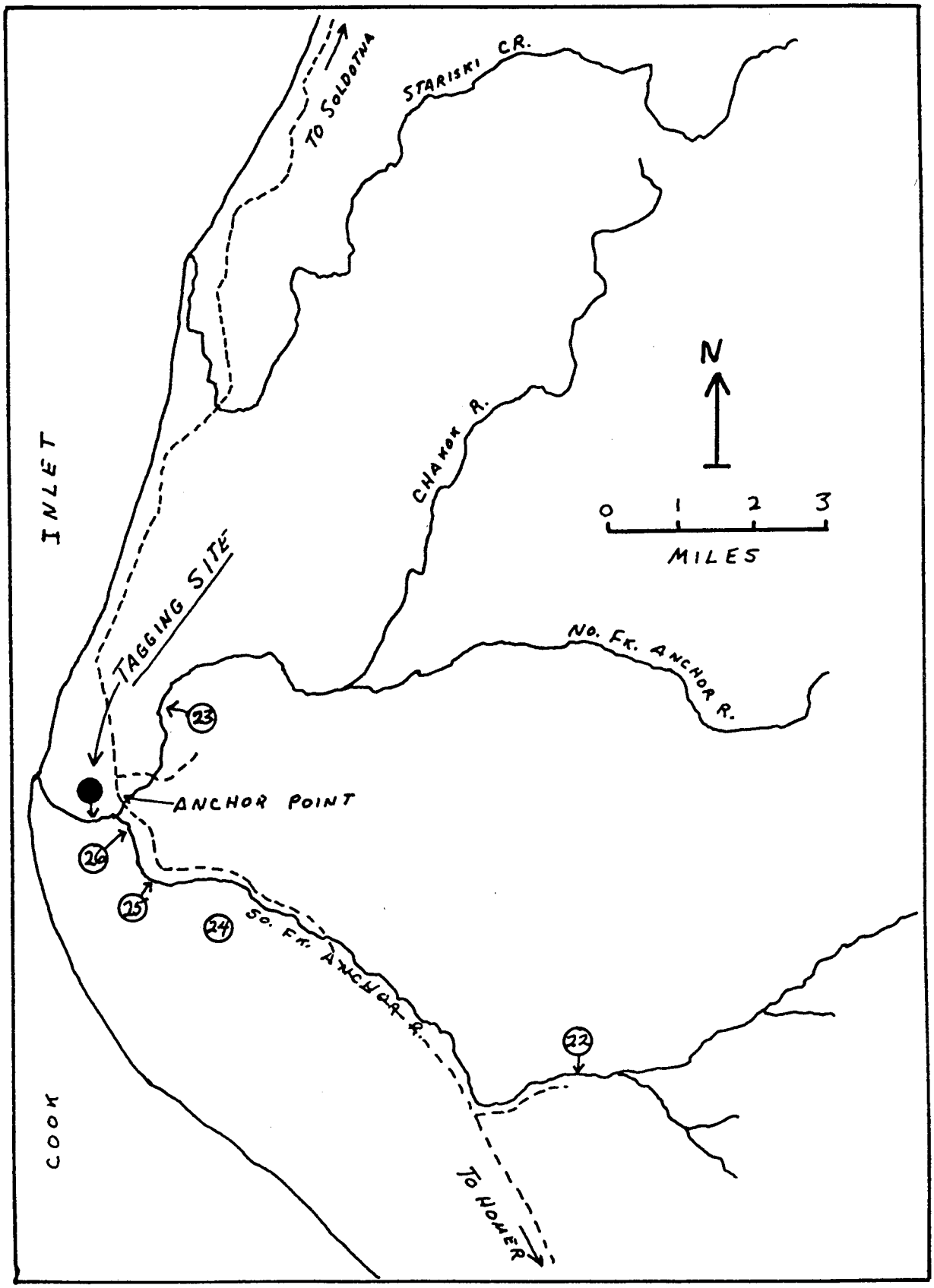

Figure 9. Site of tagging and location of uppermost signal reception for steelhead tagged with radio transmitters in Anchor River during spring 1983.

It is estimated that anglers harvested 433 steelhead from the Anchor River during the 1983 fall fishery; the harvest is listed in Table 11 by weekly period and area. A summary of angling effort, steelhead harvest and available population estimates since 1954 is presented in Table 12.

Information obtained during the 1983 creel census indicates that anglers kept 40% of the steelhead they caught. Creel census information during the years 1978-1981 indicated anglers kept 45 to 62% of the steelhead they caught, and interviews in 1982 indicated they kept 36% of the steelhead they caught. The 1983 estimated steelhead harvest is comparable to the 1982 harvest and lower than the estimated harvest for 1979, 1980 and 1981. However, if the harvest is adjusted to reflect the lower percentage of fish kept, the number caught in 1983 is comparable to the catch in previous years except 1978.

Age/Size/Fecundity Data:

Scales and lengths were collected from 113 adult steelhead during creel census interviews, tagging operations and during the hatchery brood stock collection. Total age could be determined for 96 steelhead and marine history for 111. A summary of age composition and lengths of the fish from all samples combined is presented in Table 13.

Twenty-eight (25.2%) of the steelhead had spawned previously, 25 were returning for a second spawning and three were returning to spawn a third time.

Previous percentages of repeat spawners in Anchor River have been: Allin (1954), 26%; Dunn (1961), 3.5%; Redick (1968), 24.3%; McHenry (1969), 16.2%; Wallis and Hammarstrom (1979), 17.7%; Wallis and Hammarstrom (1980), 17.5%; Wallis and Balland (1981), 19.7%; Wallis and Balland (1982), 11.1%; Wallis and Balland (1983), 33%.

Lengths of steelhead collected during various activities are listed separately in Table 14. Lengths of steelhead measured during the creel census and during the hatchery collection are similar in size. It is expected that anglers select larger fish to keep, but hatchery fish were taken as they were caught and not selected for size. Samples collected during tagging operations were not taken at random and are not directly comparable to the other samples.

Lengths and weights of 39 adult steelhead were collected during the fall fishery. The length weight relationship is illustrated in Figure 10.

Fecundity was determined from steelhead ovaries obtained from anglers during the fall fishery. Estimates obtained from the samples are listed in Table 15 and are comparable to those reported in 1982 (Wallis and Balland, 1983).

Spawning Observations:

Due to low, clear water during May and June it was possible to observe steelhead spawning in Anchor River. Ripe and spawning fish were observed in a few locations during foot surveys of accessible portions

Table 11. Estimated Sport Fish Effort and Harvest of Steelhead from Anchor River by Weekly Intervals and Area, August 13 - October 30, 1983.

Week Ending	Effort Man-Hours	Harvest Area 1**	Harvest Area 2***	Total
8/14*	1055	0	0	0
8/21	1752	6	1	7
8/28	2278	11	1	12
9/4	3666	47	9	56
9/11	2683	53	8	61
9/18	2238	63	9	72
9/25	1986	55	8	63
10/2	1752	29	5	34
10/9	2495	48	11	59
10/16	1288	16	3	19
10/23	1713	15	7	22
10/30	971	20	8	28
Total	23,877	363	70	433

* Estimates for weekend only.

** Anchor River below forks.

*** South Fork Anchor River above confluence of North Fork.

Table 12. Summary of Angler Effort, and Estimates of Harvest and Total Populations of Steelhead on Anchor River.

Year	Period Covered in Census	Effort Man-Days	Steelhead Estimates Harvest	Steelhead Estimates Total Runs	Source of Data
1954	5/29-10/23	3,000	247	511	Allin (1954)
1957	5/1-10/15	5,800	50	600	Allin (1957)
1960	5/7-10/2	5,300*	400	...	Dunn (1961)
1968	7/6-10/19	3,045	102	...	McHenry (1969)
1977	Entire year	31,515	1,072	...	Mills (1979)
1978	Entire year	42,671	1,754	4,162	Mills (1980); Wallis & Hammarstrom (1979)
1979	Entire year	44,220	782	...	Mills (1981a)
1980	Entire year	33,272	841	2,388	Mills (1981b); Wallis and Balland (1982)
1981	Entire year	34,257	777	...	Mills (1982)
1982	Entire year	24,709	551	...	Mills (1983)
1983**	May-June	...	50		Estimated Creel Census
	8/13-10/30	6,941	433		
	Total		483	1,762	

* Effort incomplete - covers period 5/7-7/14 only.

** Incomplete data, subject to revision.

Table 13. Summary of Age Composition and Lengths of Anchor River Steelhead Trout; Combined Data From All Samples Taken During Fall 1983.

Age Class	Number	Length (mm) Mean	Length (mm) Range	S.D*
First-time Spawners				
Males				
2.1	1		510	
3.1	22	544	490-625	36.8
2.2	3	725	695-755	30.0
3.2	9	719	685-760	27.2
R.2	1		760	
Total	36			
Females				
3.1	1		495	
2.2	5	672	635-700	24.1
3.2	30	683	605-740	29.5
4.2	1		630	
R.2	10	676	630-740	35.3
Total	47			
Repeat Spawners				
Males				
3.1sl	6	738	715-765	18.9
3.2sl	1		780	
R.2sl	2	780	775-785	7.1
2.2s	1		730	
Total	10			
Females				
3.1s	1		725	
4.1sl	1		700	
2.2sl	6	762	740-795	18.9
3.2sl	6	772	745-795	21.6
3.2slsl	1		840	
2.2ss	1		735	
R.2s	1		690	
R.2sls	1		800	
Total	18			

* Standard Deviation

Table 14. Mean Length of Adult Steelhead Collected in Different Sampling Programs on Anchor River, 1983.

Sample Origin	Number	Length (mm)		
		Mean	Range	S.D.*
Creel Census				
Females	36	706	495-840	58.7
Males	23	646	515-760	93.1
Anchor Tagging				
Females	19	678	590-785	40.4
Males	16	627	490-785	119.2
Hatchery Take				
Females	12	711	630-800	53.8
Males	7	642	525-750	104.6

* Standard Deviation

Table 15. Fecundity of Ten Adult Steelhead Females from Anchor River, 1983.

Length (mm)	Weight (Kg)	Total Wt. both ovaries (g)	Sample Wt. (g)	No. Eggs In Sample	Total Est. Number Eggs
670	3.1	177.3	36.2	901	4413
685	2.8	298.0	69.0	811	3503
685	3.1	193.1	54.0	1515	5418
685	3.2	132.5	30.9	1035	4438
690	3.1	208.8	48.0	1114	4846
695	3.4	166.5	52.2	1771	5649
725	3.4	378.9	66.0	768	4409
725	4.0	203.8	43.0	1214	5754
785	4.6	293.2	64.6	1584	7189
795	4.9	407.6	98.7	1924	7946

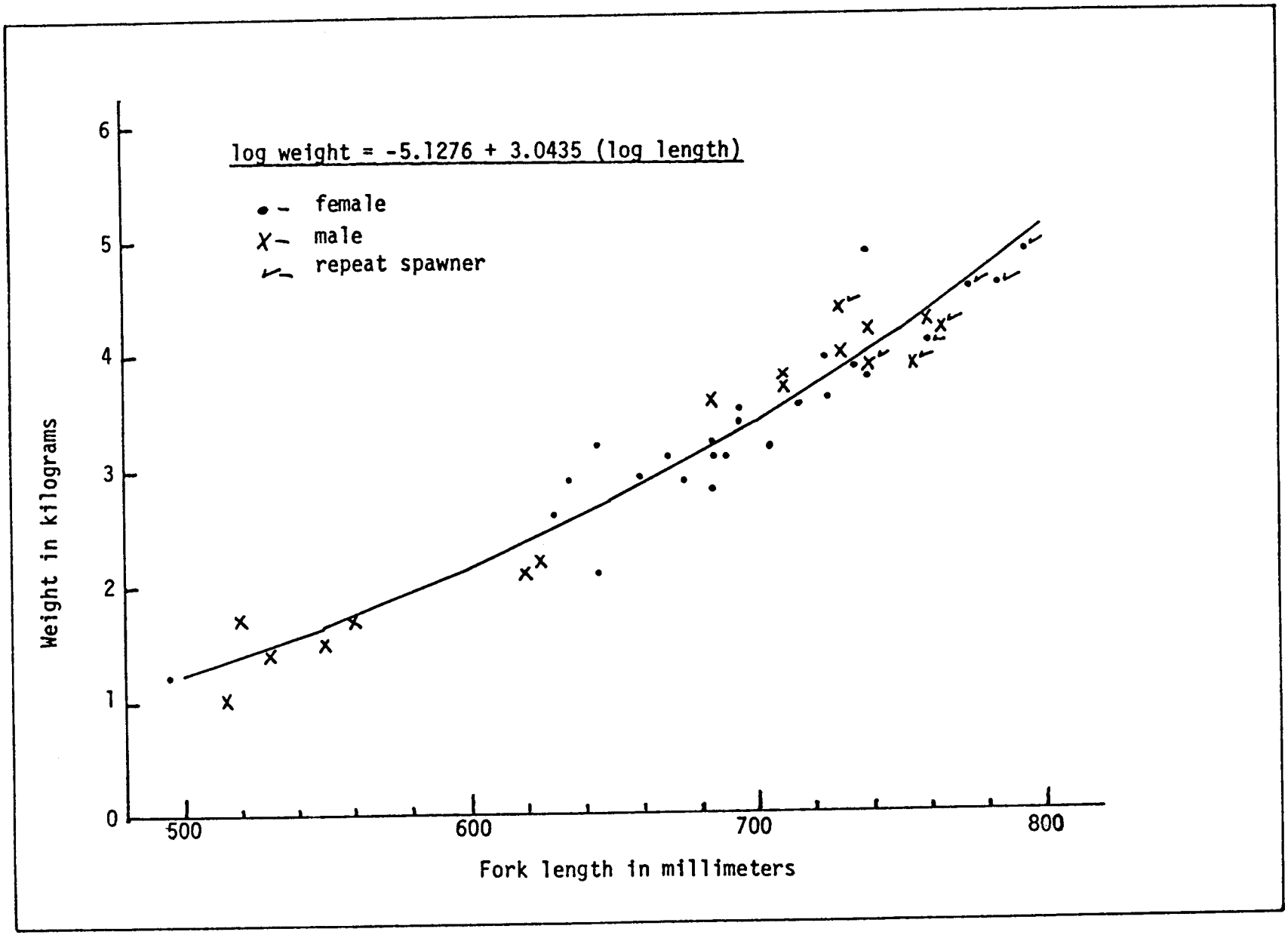

Figure 10. Length-weight relationship of adult steelhead in Anchor River, 1983.

of both the North and South Fork of Anchor River and during a raft survey of the upper area of the South Fork.

The sites of these observations are shown in Figure 11 with notations of numbers observed, dates and whether or not fish were observed actively spawning.

The earliest actively spawning fish were observed in the North Fork on May 11, and the latest spawning fish was observed in the South Fork on May 27. One ripe, but unspawned fish was captured on June 7 in the upper South Fork.

The range of dates on which actively spawning steelhead were observed encompassed the time period that radio-tagged fish migrated to and remained in areas that we concluded were their probable spawning areas. Locations of actual sightings of spawning and ripe fish, and probable spawning areas for radio-tagged fish are depicted in Figure 12.

Adult steelhead harvested during the chinook salmon fishery the last weekend in May and the first 3 weekends of June were examined for sexual maturity. With one exception, all the fish examined had spawned. Each year anglers catch substantial numbers of steelhead during the chinook salmon fishery; the majority are spent and migrating back to sea.

The exception noted above was examined on June 11 and was a male with full firm testes. It was bright silver with little coloration; it is our opinion it had been in freshwater only a short time. This observation lends credence to comments we have heard from anglers that there are some steelhead which enter the stream in spring.

Hatchery Brood Stock:

Twenty adult steelhead were captured and transported to the Trail Lakes Hatchery during the fall steelhead run (Table 16). They are to be held for spawning in the spring of 1984.

Pathology

One segment of the steelhead enhancement project is to establish a disease history of fish in Anchor River, as well as to monitor incidence of diseases at other locations involved in the overall project.

In 1981, kidney and hind gut samples of 26 adult steelhead were examined at the ADF&G pathology laboratory in Anchorage for the presence of Aeromonas salmonicida and Renibacterium salmoninarum, causative agents for Furunculosis and bacterial kidney disease (BKD), respectively. All samples were negative for these pathogens.

Bacterial kidney disease was found in four adult steelhead which died at Crooked Creek Hatchery in the fall of 1982, following their transport from Anchor River. Twenty-one adult steelhead which survived to spawn in the spring of 1983 were examined for presence of Infectious Haematopoietic Necrosis (IHN) virus, Furunculosis and BKD, and all were found to be negative.

Table 16. Numbers of Adult Steelhead Captured in Anchor River and Transported to Trail Lake Hatchery, 1983.

Date	Females	Males	Total
9/21/83	4	1	5
9/27/83	8	2	10
10/5/83	0	5	5
Total	12	8	20

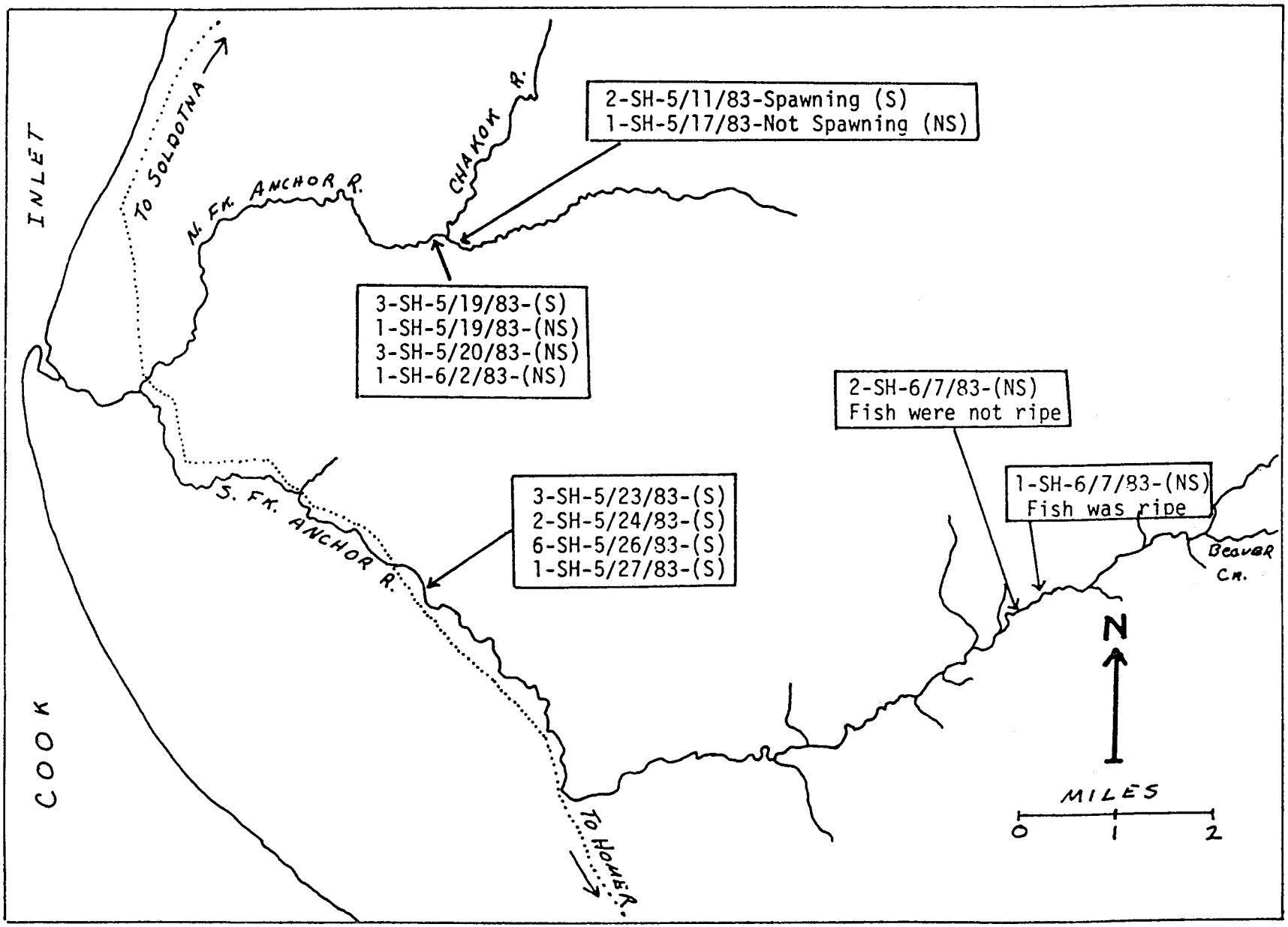

Figure 11. Map of Anchor River showing locations where steelhead were observed during spawning ground surveys, 1983.

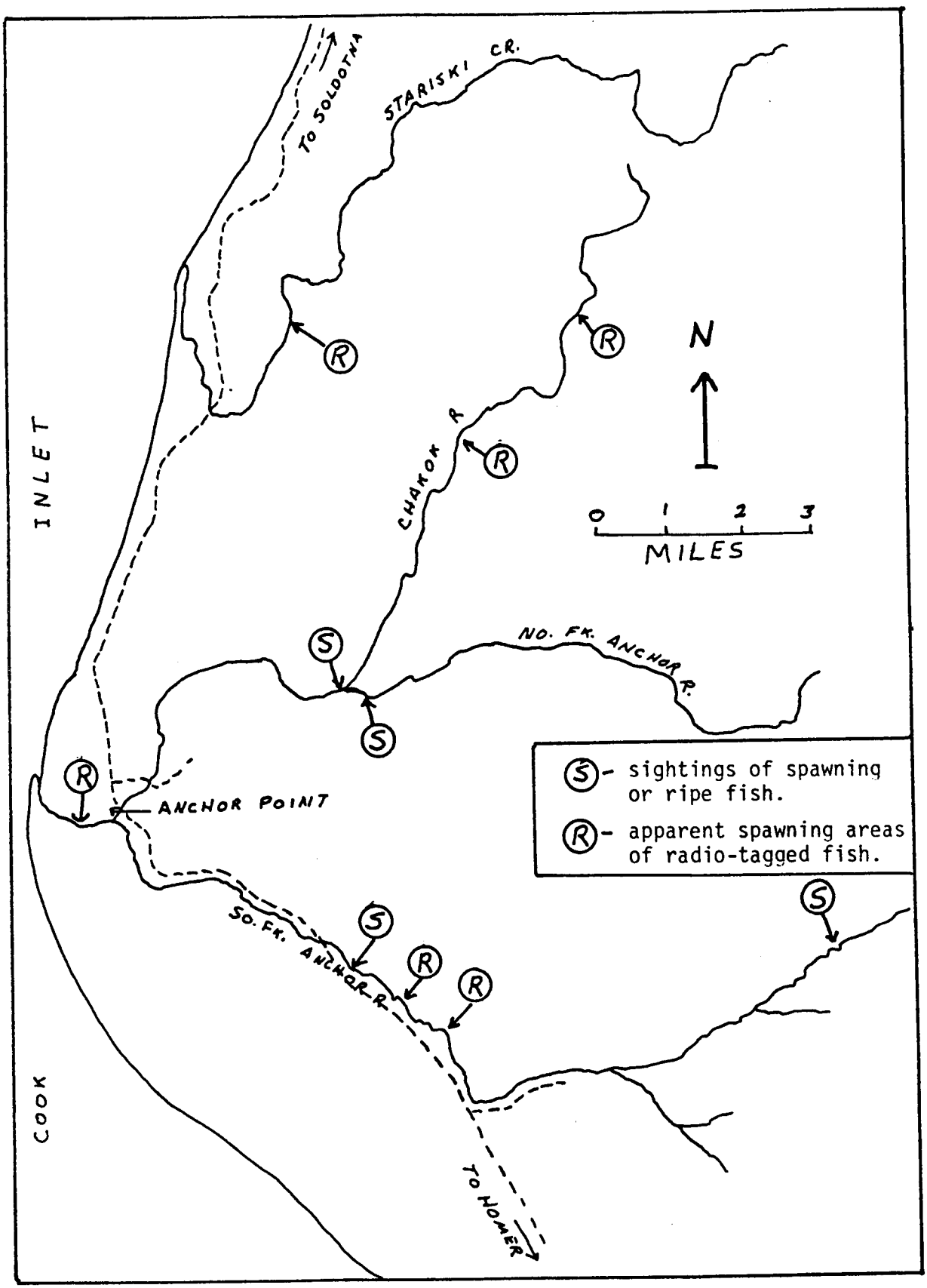

Figure 12. Steelhead spawning areas observed in Anchor River during 1983.

Juvenile steelhead of 1983 brood Anchor River stock being reared at Crooked Creek Hatchery in 1983 were examined for presence of Furunculosis and BKD; both organisms were found in the following incidence:

A. salmonicida - 38 positive in sample of 105.
R. salmoninarum - 6 positive in sample of 105.

Samples of both juvenile and adult salmonids were collected in Anchor River in 1983 and sent to the pathology laboratory in Anchorage for examination. Results of these tests are summarized in Table 17.

Need for Supplemental Production

One of the objectives of this study is to determine the need for supplementing steelhead stocks. In past reports this objective has not been addressed because we have been in the process of data collection and have not been able to draw conclusions. Data collected over the years now permit us to address some facets of this objective.

When this study was first proposed in 1978 we had little information about steelhead population and harvest levels, or angler effort directed toward steelhead. We assumed that angler effort would continue to increase and the naturally produced population could not sustain future fishing pressure without damage to the stocks unless additional restrictions were imposed on the harvest or supplemental production measures were undertaken. Based upon the assumption that supplemental production would be more acceptable to anglers, we proposed that an enhancement project be initiated to run concurrently with the biological investigation.

We expressed the opinion that Anchor River would likely be the first stream to need supplemental production because it was the most heavily utilized steelhead stream in the area. Top priority in the enhancement project was to be development of a broodstock, and second priority was to plant smolts back into Anchor River to supplement the natural stocks.

Effort, Harvest and Population Levels:

Total sportfishing effort on Anchor River peaked at over 40,000 man-days in 1978 and 1979, and has declined since then (Table 12).

Total annual effort includes that devoted to chinook and coho salmon and Dolly Varden, as well as steelhead. Most of the steelhead angling occurs after September 1, and the effort from that date until freezeup is considered to reflect angling effort directed toward steelhead, even though some of the effort is for coho and Dolly Varden.

During the summer-fall creel census studies conducted since 1977, angler effort has been estimated on a weekly basis. These estimates have been adjusted to show the sportfishing effort during the period September 1 to freezeup as an indicator of fishing effort directed toward steelhead (Table 18).

Table 17. Summary of Results of Examination of Salmonids from Anchor River for Presence of A. salmonicida and R. salmoninarum, 1983.

Species	Stage	Date	No. Sampled	No. Positive	
				A. salmonicida	R. salmoninarum
SH	Juveniles	May 1983	96	0	0
SH	Adult*	May-June 1983	3	0	0
SH	Adult**	May-June 1983	2	0	0
SH	Adult***	Sept. 1983	1	0	1
SH	Adult	Aug.-Oct. 1983	33	0	2
SS	Juveniles	May 1983	29	0	0
SS	Adult	Aug.-Sept. 1983	38	0	0
KS	Juveniles	May 1983	100	0	0
KS	Adult	May-June 1983	16	0	0

* Two were spawned fish, one had not spawned.

** Both radio-tagged fish; one in fall 1982, other spring 1983; first was spanwed, other was not.

*** Tagged with Floy anchor tag on 8/31/83 and recovered moribund 9/13/83.

Table 18. Summary of Sportfishing Effort, Harvest and Catch of Steelhead Trout During the Period September 1 Until Freezeup in Anchor River, 1978-1983.

Year	Man-Hours	Man-Days	Hours per Compl. Angler	Est. Catch No.	Est. Catch CPUE	Percent of Catch Kept	Est. Harvest No.	Est. Harvest CPUE
1978	26,814	9,786	2.74	2,933	.109	44.8	1,314	.049
1979	19,269	5,701	3.38	897	.047	62.0	556	.029
1980	16,775	6,710	2.50	1,285	.077	57.5	739	.044
1981	20,792	6,817	3.05	948	.046	53.9	511	.025
1982	15,665	4,926	3.18	1,022	.065	36.0	368	.023
1983	17,221	5,006	3.44	1,070	.062	39.8	414	.024

Maximum effort was devoted to steelhead angling in 1978 with about 9,800 man-days. Since 1978, effort has ranged between 4,900 and 6,800 man-days.

The steelhead run in 1978 was an exceptionally good one and, since that time, the population level has been much lower with a subjective assessment of run strength ranging from fair to good. Another subjective judgement is that angling intensity seems to be related to apparent run strength; i.e., when catches appear good, this information becomes publicized and more anglers show up; when catches are poor, this is also publicized, and there are fewer anglers.

Estimates of total population of steelhead in Anchor River have been made in 3 of the past 6 years (Table 12); those estimates ranged from about 1,800 to 4,200 fish. A subjective assessment of population levels is that these are among the greatest that have occurred during the period of this study, and that during the 3 years when population estimates could not be made, populations were lower.

During the 3 years total populations were estimated, the harvest levels were 42.1%, 35.2% and 24.5% for 1978, 1980 and 1983, respectively. We do not have adequate historical data to determine what effect these harvest levels will have on production.

Steelhead anglers typically release a substantial portion of fish they catch for a variety of reasons.

Anglers on Anchor River kept from about 45% to 62% of the fish they caught during the period 1978-1981. Anglers kept 36% and 40% of the steelhead they caught in 1982 and 1983, respectively. The reduction in percentage of fish kept was entirely a voluntary effort on the part of anglers who had an active vocal campaign promoting catch-and-release fishing for steelhead.

Regulatory Changes:

Several harvest regulations have been changed since 1977, with most of them aimed at reducing harvest of steelhead trout.

Up to and including 1977, there was a daily bag limit of two steelhead over 20 inches in length and no seasonal bag limit. In 1978, the daily bag limit was reduced to one fish with no seasonal limit. In 1979, the daily bag limit remained at one fish but a season limit of two fish was established. The season limit was increased to five fish in 1980, but the daily bag limit remained at one per day.

In 1977 through 1979, streams were closed to steelhead fishing from May 1 through June 30, except during the chinook salmon fishery the last weekend in May and the first 3 weekends in June. From 1980 through the spring of 1984 the closed period was extended to April 16 through June 30.

The Alaska Board of Fisheries adopted regulations in 1984 which will close the local steelhead streams during the period January 1 through

June 30, except during the chinook salmon fishery. While the daily bag limit remains at one, the season limit was changed to two fish and only artificial lures may be used from September 16 through December 31.

DISCUSSION

Some of the assumptions we made which led us to conclude that an enhancement program would be necessary were incorrect.

We assumed that angling effort would increase, however angling effort has decreased during the period of this study.

It was assumed that anglers would prefer to increase the steelhead population with hatchery-produced fish rather than accept more restrictive harvest regulations. Virtually all the more restrictive regulations adopted since 1977 have been the result of proposals which originated with anglers. In fact, some anglers have proposed regulations far more restrictive than those adopted.

During the past few years we have had increasing numbers of comments from anglers who oppose planting hatchery reared fish in Anchor River. The basis for these comments is difficult to identify, but there is a noticeable sentiment among steelhead anglers opposing hatchery plants and the idea of supplementing natural stocks with hatchery fish.

One of the more frequent comments we hear from anglers is that there are too many anglers on Anchor River. A low density of anglers is important to "quality" sportfishing, especially in a steelhead fishery. If steelhead numbers are increased substantially by hatchery reared fish, it can be assumed that the numbers of anglers will increase.

The above comments are not intended to lead to the conclusion that an enhancement program is not desirable. Rather, they are intended to point out the need for such a program in streams containing natural populations is not as great as we anticipated several years ago, and to suggest a change in direction of plans.

From a biological standpoint, steelhead stocks appear to be healthy with no suggestion of overharvest. An unexplained reduction in total sportfishing effort and anglers' voluntary reduction in their harvest level have contributed to the healthy status of the stocks. Steelhead anglers have demonstrated a willingness to accept more restrictive harvest regulations, and this will provide further insurance against future overharvest problems.

One of the foremost concerns of steelhead anglers is about the "quality" of the fishery, and about programs which would attract additional numbers of anglers to streams which are now heavily utilized, thus possibly decreasing quality.

An alternative to this would be to establish steelhead runs in new streams, thereby spreading effort into more areas. This approach was

included in the original planning, but it was to be done at an unspecified future time and had no real priority.

We have no immediate urgent need to supplement existing natural stocks. It seems appropriate that plans to establish steelhead in new areas should receive a high priority.

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